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(REV. 5-93)U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICEATTORNEY'S DOCKET NUMBER
67190/965158TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/341368

INTERNATIONAL APPLICATION NO.
PCT/DE98/00035INTERNATIONAL FILING DATE
(07.01.98)
7 January 1998PRIORITY DATES CLAIMED
(09.01.97)
9 January 1997

TITLE OF INVENTION

REDUCTION OF SWITCH-ON TIME FOR ELECTRONICALLY CONTROLLED CONTACTORS

APPLICANT(S) FOR DO/EO/US

Wilfried JAEHNER, Franz ULTSCH, Bernhard STREICH, Diethard RUNGGALDIER and Reinhard MAIER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
 2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
 3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
 4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
 5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
 6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
 7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
 8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
 9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) UNSIGNED.
 10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
- Items 11. to 16. below concern other document(s) or information included:
11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
 13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
 14. ☐ A substitute specification.
 15. ☐ A change of power of attorney and/or address letter.
 16. ☒ Other items or information: copy of First Page of Published Application, Preliminary Examination Report, International Search Report and PCT/RO/101.

17. ☒ The following fees are submitted:**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EPO or JPO \$840.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) ... \$670.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but
international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$750.00Neither international preliminary examination fee (37 CFR 1.482) nor international
search fee (37 CFR 1.445(a)(2)) paid to USPTO \$970.00
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all
claims satisfied provisions of PCT Article 33(2)-(4) \$96.00

CALCULATIONS | PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$ 840

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months
from the earliest claimed priority date (37 CFR 1.492(e)).

\$

Claims	Number Filed	Number Extra	Rate		
Total Claims	3 - 20 =	0	X \$18.00	\$ 0	
Independent Claims	1 - 3 =	0	X \$78.00	\$ 0	
Multiple dependent claim(s) (if applicable)			+ \$260.00	\$	

TOTAL OF ABOVE CALCULATIONS =

\$ 840

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must
also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$

SUBTOTAL =

\$ 840

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30
months from the earliest claimed priority date (37 CFR 1.492(f)).

+

\$

TOTAL NATIONAL FEE =

\$ 840

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

+

\$

TOTAL FEES ENCLOSED =

\$ 840

Amount to be:
refunded

\$

charged

\$

- a. ☐ A check in the amount of \$_____ to cover the above fees is enclosed.
- b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of **\$840.00** to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SIGNATURE

Kenyon & Kenyon
One Broadway
New York, New York 10004Richard L. Mayer, Reg. No. 22,490
NAME

DATE

PCT
 WELTORGANISATION FÜR GEISTIGES EIGENTUM
 Internationales Büro
 INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE
 INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)



(51) Internationale Patentklassifikation ⁶ : H01H 47/04	A1	(11) Internationale Veröffentlichungsnummer: WO 98/31034 (43) Internationales Veröffentlichungsdatum: 16. Juli 1998 (16.07.98)
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(21) Internationales Aktenzeichen: PCT/DE98/00035
(22) Internationales Anmeldedatum: 7. Januar 1998 (07.01.98)

(30) Prioritätsdaten:
 197 00 522.5 9. Januar 1997 (09.01.97) DE

(71) Anmelder (für alle Bestimmungsstaaten ausser US): SIEMENS AKTIENGESELLSCHAFT [DE/DE]; Wittelsbacherplatz 2, D-80333 München (DE).

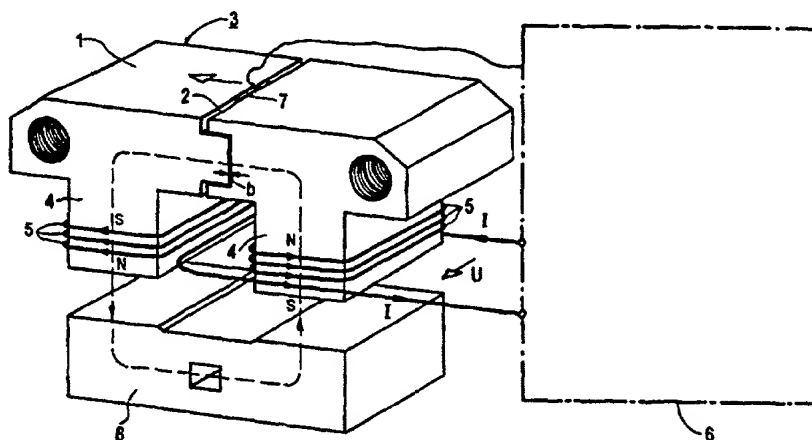
(72) Erfinder; und
(73) Erfinder/Anmelder (nur für US): JAEHNER, Wilfried [DE/DE]; Schwandorfer Strasse 29, D-90482 Nürnberg (DE). ULTSCH, Franz [DE/DE]; David-Morgenstern-Weg 21, D-91056 Erlangen (DE). STREICH, Bernhard [DE/DE]; Asamstrasse 1, D-92224 Amberg (DE). RUNGGALDIER, Diethard [IT/DE]; Amselweg 5, D-96135 Stegaurach (DE). MAIER, Reinhard [DE/DE]; Anna-Herrmann-Strasse 54, D-91074 Herzogenaurach (DE).

(81) Bestimmungsstaaten: CN, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht
Mit internationalem Recherchenbericht.
Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist. Veröffentlichung wird wiederholt falls Änderungen eintreffen.

(54) Title: REDUCED TENSIONING TIME FOR ELECTRONICALLY CONTROLLED SWITCH CONTACTORS

(54) Bezeichnung: REDUKTION DER EINSCHALTZEIT BEI ELEKTRONISCH GESTEUERTEN SCHÜTZEN



(57) Abstract

The present invention relates to a switching equipment, including relays and/or switch contactors with a magnetic system, the armature and the yoke, a winding and the winding support as well as a control and/or drive system of the switching equipment, where the real value of the switching-drive parameters is determined using sensors. When a switching order is given, the control system affects an output quantity (for example, the winding tension of level I) only after the switching parameters have reached at least a certain threshold value (for example, the contact speed v).

[67190/965158]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s) : Wilfried JAEHNER et al.
Serial No. : To Be Assigned
Filed : Herewith
For : REDUCTION OF SWITCH-ON TIME FOR
ELECTRONICALLY CONTROLLED CONTACTORS
Examiner : To Be Assigned
Art Unit : To Be Assigned

Assistant Commissioner
for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

SIR:

Kindly amend the above-identified application
before examination, as set forth below.

IN THE SPECIFICATION:

Please amend the specification as follows:

On page 1, delete line 1, and insert:

--FIELD OF THE INVENTION--.

On page 1, line 3, before "invention" insert --
present--.

On page 1, before line 9, insert:

--BACKGROUND INFORMATION--.

On page 1, line 25, delete "A1".

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On page 1, line 29, change
"Offenlegungsschrift" to --Patent No.--, and delete "A1".

On page 2, line 3, change "Offenlegungsschrift"
to --Patent No.--, and delete "A1".

On page 2, line 10, change "known" to --
conventional--.

On page 2, before line 17, insert:
--SUMMARY--.

On page 2, line 17, change "The" to --An--.

On page 2, line 27, change "v" to --and/or the
contact path and/or the flux--.

On page 2, line 33, delete "t", "s" and
"according to Claim 2".

On page 2, line 34, delete " Φ " and "I".

On page 2, line 35, delete "according to Claim
5".

On page 3, delete lines 5 and 6, and insert:
--BRIEF DESCRIPTION OF THE DRAWINGS--.

On page 3, line 9, change ";" to --.---.

On page 3, line 13, change ";" to --.---.

On page 3, before line 19, insert:
--DETAILED DESCRIPTION--.

On page 5, delete line 1, and insert:
--What Is Claimed Is--.

IN THE ABSTRACT:

Please amend the abstract as follows:

Line 11, delete "I".

Line 12, delete "v".

Delete line 15.

IN THE CLAIMS:

Please cancel, without prejudice, claims 1-4 in the underlying PCT application. Please also cancel, without prejudice, claims 1-3 of the revised pages in the annex to the International Preliminary Examination Report.

Please add the following new claims:

4. (New) A solenoid system for switchgear, comprising:
- an armature;
 - a yoke;
 - a coil interacting with the yoke to move the armature;
 - sensors detecting actual values of drive-specific switching parameters; and
 - a control device of a switchgear drive, the control device being one of an open-loop control device and a closed-loop control device, wherein after a switching command, the control device does not affect an output quantity for controlling the coil until at least one predefined threshold value of the switching parameters is attained, the output quantity being a coil current, the switching parameters being variable during a switching operation and including at least one of a contact speed, a contact path and a flux.

5. (New) The solenoid system according to claim 4, wherein after the switching command, the control device does not affect the output quantity until at least at least one predefined value of the switching parameters is attained, the switching parameters including the contact speed.

6. (New) The solenoid system according to claim 4, wherein the at least one threshold value is settable.

REMARKS

This Preliminary Amendment cancels, without prejudice, claims 1-4 in the underlying PCT Application No. PCT/DE98/00035. This Preliminary Amendment further cancels, without prejudice, claims 1-3 of the revised pages in the annex to the International Preliminary Examination Report, and adds new claims 4-6. The new claims conform the claims to U.S. Patent and Trademark Office rules and does not add new matter to the application.

The above amendments to the specification and abstract are to conform the specification and abstract to U.S. Patent and Trademark Office rules and to correct informalities. The amendments to the specification and the abstract do not add new matter.

The underlying PCT Application No. PCT/DE98/00035 includes an International Search Report. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report is included herewith.

The underlying PCT Application also includes an International Preliminary Examination Report, dated February 1, 1999. An English translation of the Preliminary Examination Report and the annex thereto is included herewith.

It is respectfully submitted that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,
KENYON & KENYON

Dated:

7/8/88

By:

Richard L. Mayer

Richard L. Mayer
Reg. No. 22,490

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REDUCTION OF SWITCH-ON TIME FOR ELECTRONICALLY
CONTROLLED CONTACTORS

Background Information

The invention concerns switchgear, in particular relays and/or contactors with a solenoid system that includes an armature and a yoke, a coil and an open- or closed-loop controller of the switchgear drive, wherein actual values of drive-specific switching parameters are measured by sensors.

Switchgear having solenoid systems, for example, contactors, are used in drive and automation technology and serve, in conjunction with other components for protecting and controlling electric loads.

In order to optimize such switchgear to their switching function, taking into consideration different operating conditions and specific equipment characteristics, the principle of controlled switching drives has been developed, which reduces the number of types of coils that were previously required due to their different excitation voltages. Such drives can be used for both AC and DC and, by reducing contact chatter, they reduce contact erosion and extend contact life. At the same time, the power consumption of the exciter circuit during the holding phase is reduced.

Thus, European Patent Application 376 493 A1 describes a control circuit that allows for a high current during the closing operation of electromagnetic valves; this current is then reduced to a relatively low holding current after the closing operation. German Offenlegungsschrift 30 47 488 A1 describes, in addition to a coil current controller, an induction controller with a Hall probe arranged in the yoke. These control principles provide a higher coil current for the closing operation, which is reduced after the closing

operation to a value that just provides for the force required for holding the armature in the closed position. German Offenlegungsschrift 44 30 867'A1 describes a switchgear drive control, which ensures that the optimum contact speeds and the limitation of the armature core impact speed are observed over the entire service life, taking into consideration interfering factors such as erosion and tolerances.

While efforts have been made to achieve the aforementioned object using the known circuit arrangements for switchgear drives, either complex control algorithms have had to be used or concessions concerning the requirements of high closing speed of the contact with minimized chatter and low power consumption during the holding phase of the contactor have had to be made.

The object of the present invention is to provide a simple and sturdy control algorithm of the switchgear drive resulting in minimum chatter of these contacts and low power consumption of the exciter circuit during the holding phase of the contactor.

This object is achieved according to the present invention by the fact that, after a switching command, the control device does not affect an output quantity, for example, coil current (I), until at least a predefined threshold value of the switching parameters that are variable during a switching operation, for example, the contact speed and/or the contact path and/or the flux, is attained.

Thus it is achieved that the closing speed is very high, like in conventional contactor drives. After one or more limit values of specific switching parameters has been attained, such as time t or contact path s according to Claim 2, the control device intervenes via flux Φ or coil current I and thus minimizes chatter. In addition, power consumption by the exciter circuit during the holding phase of the contactor is thus reduced. These threshold values can be transmitted to the

control device via sensors. Lag elements in the control circuit also result in delayed response of the control device.

The invention is described with reference to an embodiment.

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Figure 1 shows a U core with fixed air gap, armature, coil and their control device;

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Figure 2 shows a diagram where the magnetic flow Φ during the closing operation is plotted against time for different control principles;

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Figure 3 shows a diagram where the armature path s during the closing operation is plotted against time t for different control principles.

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Figure 1 shows a yoke 1 designed as a U core 3 having a fixed air gap 2. A schematically illustrated coil 5, activated via a control device 6, is located on each leg 4 of yoke 1. A flux sensor 7, which transmits the instantaneous flux data to control device 6, is arranged in fixed air gap 2.

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Figure 2 shows the variation of magnetic flux Φ in fixed air gap 2 of magnet yoke 1 over time t for different control principles. In the case of uncontrolled variation of magnetic flux Φ , i.e., the entire control voltage U is always applied to coil 5, flux Φ has a variation A that is typical for the magnetic field, causing maximum acceleration of armature 8, which may then result in chatter on the fixed contact of the switchgear.

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Curve C shows the variation of magnetic flux Φ when control device 6 intervenes immediately. Also in this case, the entire voltage U is applied to coil 5 up to time t_1 . As soon as the predefined flux Φ_1 is attained, coil current I is controlled so that this value Φ_1 of the flux is maintained virtually constant during the remaining time of the closing

operation and during the holding phase of the contactor.

If control device 6 intervenes with a delay according to curve B, the entire control voltage U is again applied to coil 5, i.e., maximum acceleration initially occurs as in the case of unregulated contactor operation. After the elapse of a certain period of time t_2 after the switch-on command of the contactor t_0 , control device 6 intervenes and, based on the value transmitted by flux sensor 7, reduces, by time t_3 , coil current I and thus of flux Φ to Φ_1 , which is sufficient for maintaining the contactor closed, while reducing chatter.

Figure 3 shows the variation of contact path s of a contactor over time t for different control principles, s_0 being the open switch position and s_g being the closed switch position. In the case of unregulated contactor operation according to curve D, the contact closes fastest t_{IV} , since the full control voltage U is always applied to coil 5.

When the contactor drive is controlled immediately by control device 6 at time t_{II} according to curve F, the longest switch-on times t occur, since, as in the case of curve C of Figure 2, the entire control voltage U is only applied for a short period of time t_I to t_{II} .

According to curve E of Figure 3, the total switch-on time is reduced from t_{VI} to t_V , i.e., by approximately 20% to 30% when control starts with a delay at time t_{III} .

As tests have shown, the relationships can be directly applied to solenoid systems whose yoke has an E-shaped design, for example.

New Patent Claims

1. Switchgear, in particular relays and/or contactors with a solenoid system having an armature (8) with a yoke (1), a coil (5) and an open- and/or closed-loop control device (6) of the switchgear drive, the actual values of the drive-specific switching parameters being detected by sensors (7), characterized in that after a switching command the open- and/or closed-loop control device (6) does not affect an output quantity for controlling the coil (5), for example, the coil current (I), until at least one predefined threshold value of the switching parameters that are variable during the switching operation, for example, of the contact speed (v) and/or the contact path (s) and/or the flux (Φ), is attained.attained.
2. The switchgear according to Claim 1, characterized in that after a switching command, the open- and/or closed-loop control device does not affect an output quantity, for example, the coil current (I) until at least one predefined threshold value of the switching parameters, for example, the contact speed (v), is attained.
3. The switchgear according to one of the foregoing claims, characterized in that threshold values of the time (t) and/or the contact path (s) and/or the contact speed (v) and/or the coil current (I) and/or the flux (Φ) can be set.

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[67190/965158]

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operation to a value that just provides for the force required for holding the armature in the closed position. German Offenlegungsschrift 44 30 867 A1 describes a switchgear drive control, which ensures that the optimum contact speeds and the limitation of the armature core impact speed are observed over the entire service life, taking into consideration interfering factors such as erosion and tolerances.

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The object of the present invention is to provide a simple and sturdy control algorithm of the switchgear drive resulting in high contact closing speed and minimum chatter of these contacts and low power consumption of the exciter circuit during the holding phase of the contactor.

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Thus it is achieved that the closing speed is very high, like in conventional contactor drives. After one or more limit values of specific switching parameters has been attained, such as time t or contact path s according to Claim 2, the control device intervenes via flux Φ or coil current I according to Claim 5 and thus minimizes chatter. In addition, power consumption by the exciter circuit during the holding phase of the contactor is thus reduced. These threshold values

can be transmitted to the control device via sensors. Lag elements in the control circuit also result in delayed response of the control device.

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2. The switchgear according to Claim 1, characterized in that after a switching command the open- and/or closed-loop control device does not affect an output quantity, for example, the coil current (I) until at least one predefined threshold value of the switching parameters, for example, the contact speed (v), is attained.
3. The switchgear according to one of the foregoing claims, characterized in that threshold values of the time (t) and/or the contact path (s) and/or the contact speed (v) and/or the coil current (I) and/or the flux (Φ) can be set.
4. The switchgear according to one of the foregoing claims, characterized in that the open- and/or closed-loop control device (6) has the flux (Φ) and/or the coil current (I) as the output quantity.

Abstract of the Disclosure

Switchgear, in particular relays and/or contactors having a solenoid system with armature and yoke, a coil and an open-
5 and/or closed-loop control device of the switchgear drive are described, wherein actual values of drive-specific parameters are detected by sensors.

10 After a switching command, the open- and/or closed-loop control device does not affect an output quantity (e.g., coil current I) until at least one predefined threshold value of the switching parameters (for example, of contact speed v) is attained.

15 Figure 1

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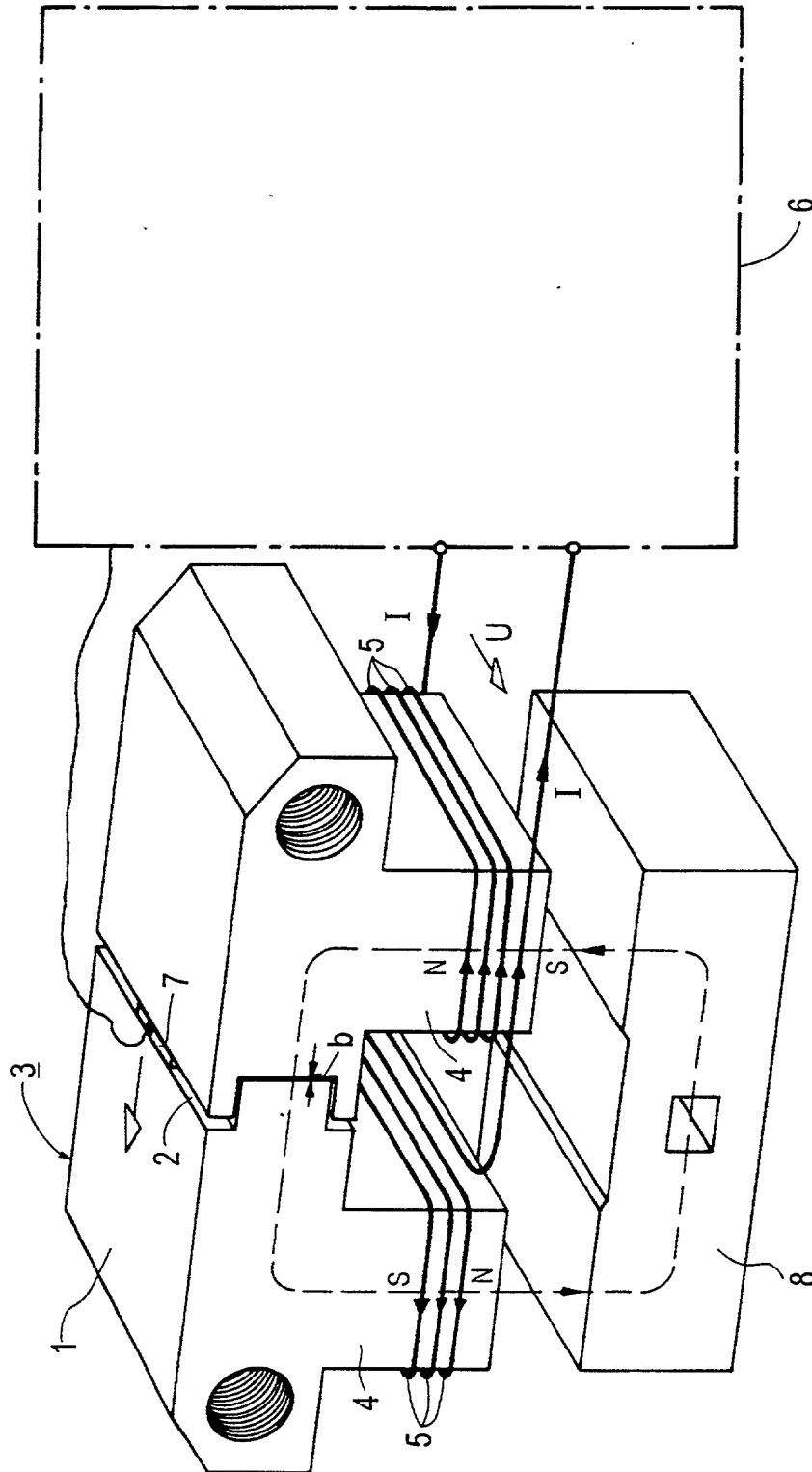


FIG 1

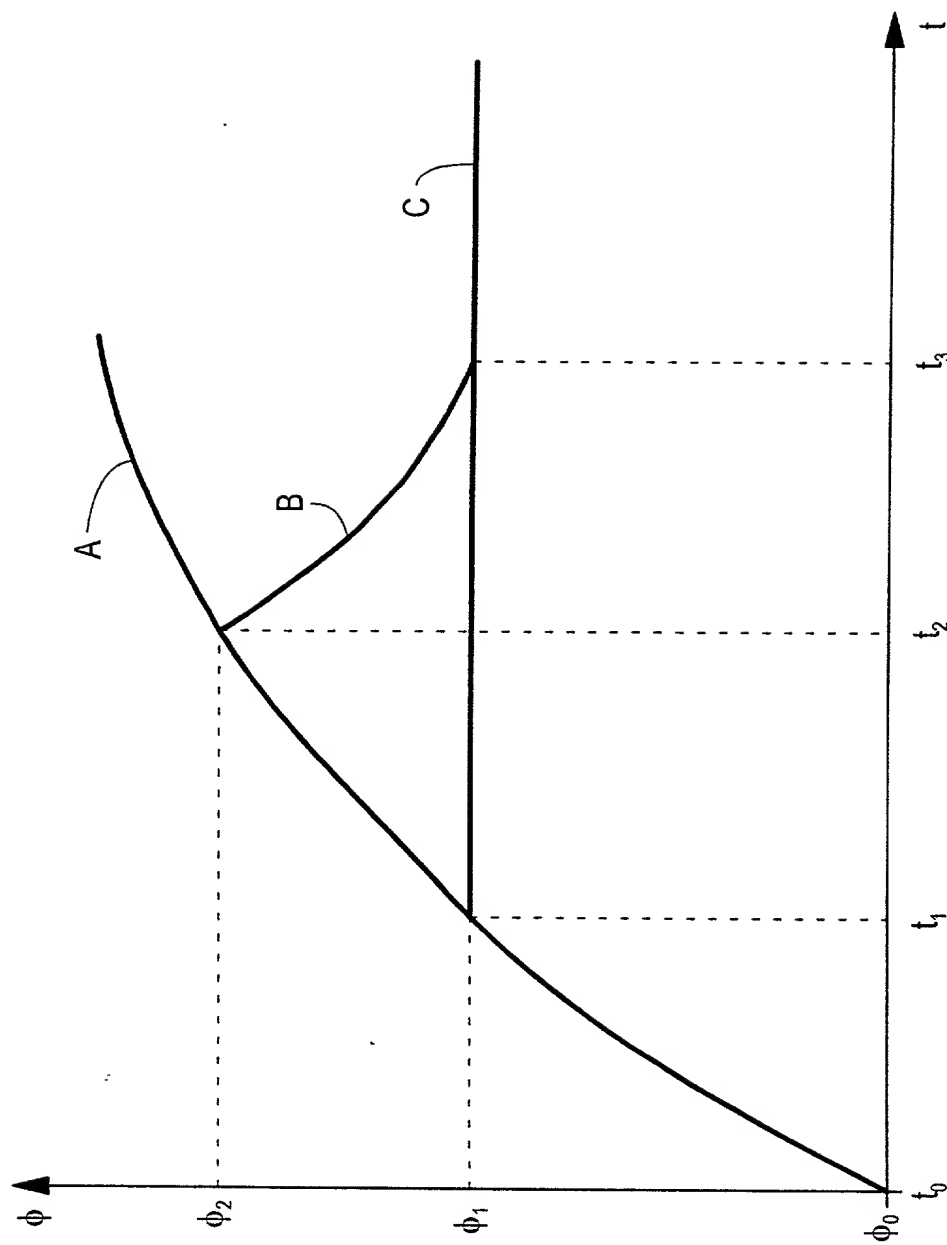


FIG 2

655007 89674660

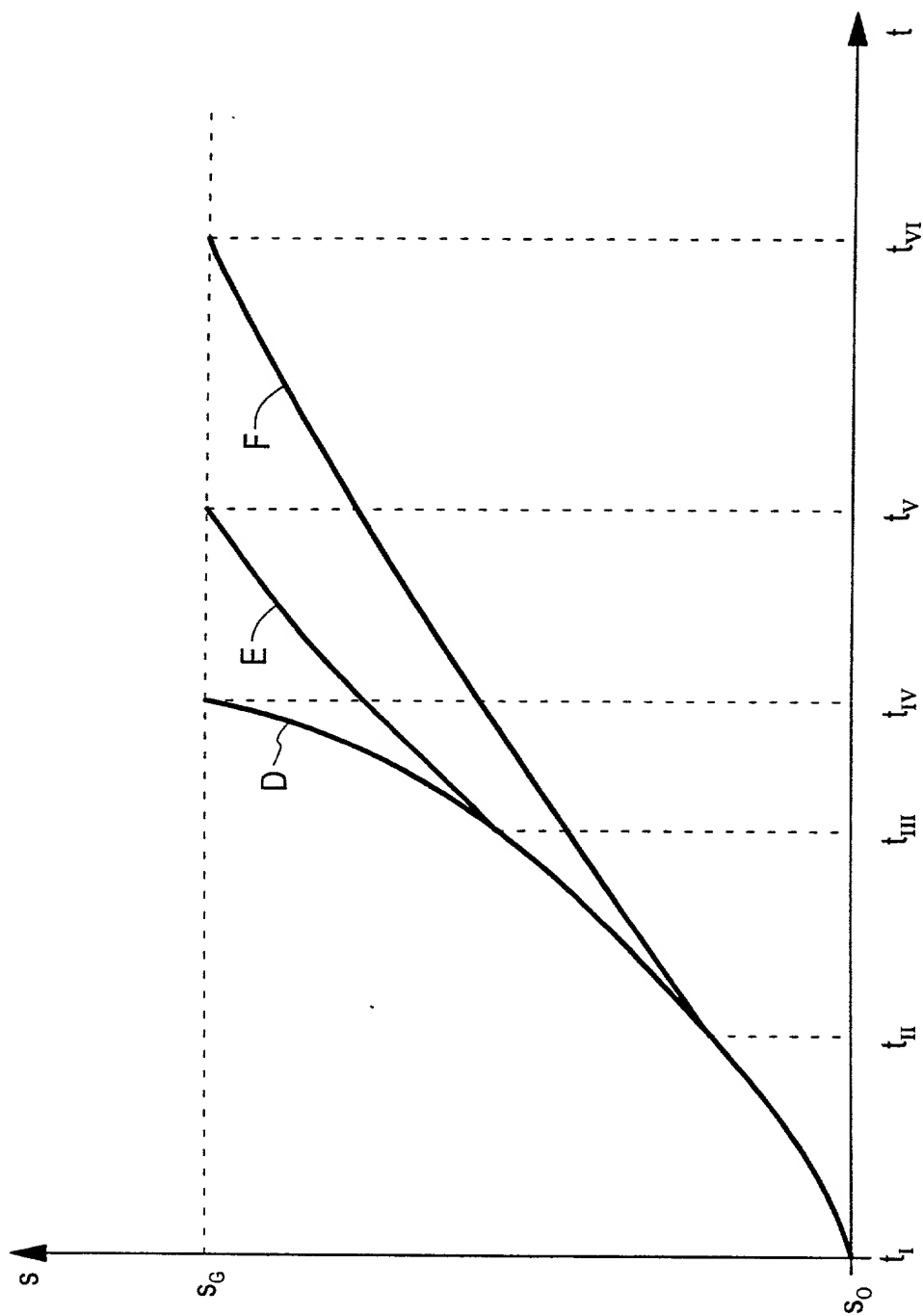


FIG 3

665007-23E14E60

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **REDUCTION OF SWITCH-ON TIME FOR ELECTRONICALLY CONTROLLED CONTACTORS**, for which an application for Letters Patent was filed as PCT Application No. **PCT/DE98/00035** on **January 7, 1998**.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

Number	Country	Day/month/year filed	Priority Claimed Under 35 USC §119
197 00 522.5	Fed. Rep. of Germany	9 January 1997	YES

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3 And I hereby appoint Richard L. Mayer (Reg. No. 22,490), Gerard A. Messina (Reg. No. 35,952), and Michelle M. Carniaux (Reg. No. 36,098) my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Please address all communications regarding this application to:

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Please direct all telephone calls to Richard L. Mayer at (212) 425-7200.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful and false statements may jeopardize the validity of the application or any patent issued thereon.

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